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REMARKS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1-19 are pending in the present application. Claims 1, 2, 10, and 11 have been amended by the present amendment, and Claims 18 and 19 have been added by the present amendment.

In the outstanding Office Action, Claims 1-6 and 8-17 were rejected under 35 U.S.C. § 103(a) as unpatentable over Applicants' submitted art in view of Motegi (U.S. Patent No. 5,353,292), and further in view of Katsuhiko (Japan Patent Publication No. 5-100267). This rejection is respectfully traversed.

Claim 1 is directed to a laser wavelength conversion apparatus including: a wavelength conversion element for performing wavelength conversion of laser light entered from an entrance end surface and delivering laser light of a shortened wavelength from an exit end surface; a heat sink surrounding a peripheral surface of the wavelength conversion element and having cooling fins; a heater for uniform heating disposed in the heat sink and surrounding the peripheral surface of the wavelength conversion element; a temperature sensor for measuring a temperature of the wavelength conversion element; and a heater controller for controlling an electric current supplied to the heater for uniform heating so that the temperature measured by the temperature sensor becomes a preset temperature.

As amended, Claim 1 now recites that the cooling fins formed on upward sides of the heat sink have planar faces extending vertically, and that the planar faces of the cooling fins formed on the upward sides of the heat sink are arranged perpendicular to planar

faces of the cooling fins formed on the lower and upper sides of the heat sink.¹

By way of background, Applicants note that a need has recently arisen to dynamically vary the repetition frequency of laser light converted by wavelength conversion apparatuses (page 4, lines 18-21). These dynamic variations in repetition frequency result in corresponding variations in the temperature of optical crystal devices (page 4, lines 21-26). Thus, an improved means of cooling is required to stably maintain optical crystal devices at the temperatures maximizing conversion efficiency (page 4, line 27 to page 5, line 11). The present invention is provided to, in part, to satisfy this recent need (page 5, lines 12-19).

In a non-limiting example, Figure 1 illustrates one configuration of the cooling fins of the present invention. As shown, each of the side 23A, top 23B, and bottom 23C cooling fins have faces extending vertically (page 11, lines 2-5). By this arrangement, the heat released by the side cooling fins 23A can ascend away from the apparatus without restriction, thereby improving cooling (page 12, lines 19-21). Further, as shown, the planar faces of the side cooling fins 23A are arranged perpendicular to the planar faces of the top 23B and bottom 23C cooling fins (page 12, lines 22-23). By this arrangement, the heat released from the side cooling fins 23A is blocked from entering the spaces between the top cooling fins 23B, and the heat released from the bottom cooling fins 23C is blocked from entering the spaces between the side cooling fins 23A, thereby further improving cooling (page 12, line 23 to page 13, line 1).

According to the outstanding Office Action, Motegi and Katsuhiro do not disclose the use of cooling fins to cool the heat sink of a laser wavelength conversion apparatus, but cooling fins are well known in the art for radiating excessive heat (Office Action, September

¹ As amended, Claim 1 no longer recites that the wavelength conversion element is divided along a direction of an optical axis. This limitation was previously added in view of the prior indication, via the Office Action dated March 27, 2003, that Claim 7 was allowable. More particularly, for purposes of accelerating prosecution, applicants amended independent Claim 1 to include the allowable subject matter of dependent Claim 7. Claim 1 is now rejected in view of newly applied art. Thus, the subject matter of Claim 7 has been removed from amended Claim 1, and is now submitted in new dependent claim 18.

4, 2003, page 3). Applicants respectfully note that general conclusions concerning what is basic knowledge to one of ordinary skill in the art, without specific factual findings and some concrete evidence in the record to support such findings, cannot support an obviousness rejection (MPEP §2144.03B). Moreover, it is never appropriate to rely solely on common knowledge in the art without evidentiary support in the record, as the principal evidence upon which a rejection is based (MPEP §2144.03A). It appears the Office Action is taking Official Notice that cooling fins are well known in the art, taking of such notice is respectfully traversed. Thus, applicants further respectfully request citation of a reference demonstrating that the use of cooling fins is well known in the art of wavelength conversion apparatuses.

The outstanding Office Action further states, with respect to whether the cooling fins are arranged in a vertical or horizontal direction, that it is not inventive to discover the optimum condition by routine experimentation (Office Action, September 4, 2003, page 5).² That statement appears to be taken from MPEP 2144.05, which pertains to the “Obviousness of Ranges”. Thus, applicants respectfully submit that this reasoning is inapplicable, and that the resulting rejection is improper.

Moreover, the specifically claimed orientation of the cooling fins in the claims provides enhanced results in the claimed device. As stated above, the vertical arrangement of the side cooling fins 23A ensures that the heat released by these fins ascends away from the apparatus without restriction. Similarly, the perpendicular configuration of the side cooling fins, with respect to the top 23B and bottom 23C cooling fins, prevents released heat from reheating the heat sink. Facilitating the release of heat and preventing its recapture is beneficial to cooling a laser wavelength conversion apparatus.

² This statement was made with respect to Claim 2, the subject matter of which is now incorporated into Claim 1.

Accordingly, for the reasons stated above, Applicants respectfully request the rejection of Claims 1-6 and 8-14 be withdrawn.

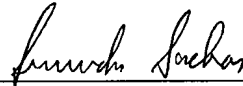
As amended, Claim 2 now recites that the surface area of the cooling fins increases from the entrance end surface of the heat sink to the exit end surface of the heat sink. In a non-limiting example, Figure 6 of the present application illustrates such a configuration of the cooling fins. As shown, the lengths of the side cooling fins 23A-1, and their corresponding surface areas, increase from the entrance end surface to the exit end surface of the heat sink (page 18, lines 2-8). By this arrangement, the amount of heat released toward the exit end surface side is increased in comparison to the heat released toward the entrance end surface side (page 18, lines 5-10). Thus, the increasing temperature gradient along the direction of the optical axis of the non-linear optical crystal device 21 can be eliminated (page 18, lines 10-14). Accordingly, Applicants respectfully submit that Claim 2 is further distinguished over the prior art.

Claims 10-17 were added by the prior amendment submitted in response to the Office Action dated March 27, 2003. More particularly, Claims 10-17 were added to set forth the subject matter of Claims 1-6, 8, and 9 in means-plus-function format. The amendments to Claims 10 and 11 reflect the amendments to Claims 1 and 2. In addition, Claim 18 has been added to recite Claim 7 as originally presented, and Claim 19 has been added to recite the subject matter of Claim 7 in means-plus-function format. It is respectfully submitted that Claims 10-19 are allowable for similar reasons as Claims 1-6 and 8-9.

Consequently, in light of the above discussion and in view of the present amendment, the present application is believed to be in condition for allowance, and an early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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